NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3210 FINAL EXAM 12/88Po

- This exam is open book and notes.
- There are five problems; each is equally weighted.
- Partial credit will be given; be sure to do some work on each problem.
- Be sure to include units in your answers.
- Please circle or underline your answers.
- Show *ALL* work.
- Write only your name on this sheet.
- Exams and course grades will be available in the ECE Office in Sp 437 on Monday, 21 December.

Course grade: _____

1		4	
2		5	
3			
Total			

Name: _____

1. Consider unpolarized light that passes through five linear polarizers. The sequence of polarizers and the alignment of their polarization axis from the vertical are indicated in the table below. Calculate the fraction of the incident power that is transmitted through the combination of polarizers.

Polarizer number	Angle of axis from vertical
1	0°
2	20°
3	15°
4	40°
5	120°

2. Consider a Doppler–broadened argon laser operating at 488 nm. A Mach–Zender interferometer experiment produces the coherence data shown below. If argon has a relative atomic mass of 18, calculate the temperature of the gas in the laser.

3. A helicopter design team allocates 50 watts to power a blackbody source to act as an IR beacon at 1.1 μm. If the source is operated at a temperature that maximizes the engineering efficiency, calculate the fraction of the total photon emittance that occurs in the visible portion of the optical spectrum.

4. Consider a four–level laser with the energy levels drawn below. If the minimum pump power is 3 watts per cubic centimeter of laser medium, calculate the threshold population inversion for a rod of laser material that is 2 cm in diameter and 15 cm long.

5. Consider a laser resonator with two concave mirrors that have a radius of curvature of +2 m and a mirror spacing of 1 m. The laser operates at 500 nm. Calculate

   (a) the spot size of the beam *and*

   (b) the radius of curvature of the phase at a location that is 30 cm to the left of the beam waist.